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USSR Report

MACHINE TOOLS AND METALWORKING EQUIPMENT

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NEW GENERATION OF MACHINES REVIEWED

Moscow EKONOMICHESKAYA GAZETA in Russian No 42, Oct 85 p 10

[Article by L. N. Koshkin, academician: "New Class of Machines"]

[Text] The April (1985) Plenum of the CPSU Central Committee formulated the priority problem of the development of machinebuilding affecting the revolutionary progress in science and technology to a decisive degree. We are speaking about a rapid changeover to the production of new generations of machines and equipment, capable of providing the introduction of progressive technology, increasing productivity of labor many times, reducing materials consumption and increasing the output-capital ratio.

Contradictions and Unity of Functions

As is well known, the most widely used machines at present are characterized by the fact that their transportation and technological functions are contradictory (mutually exclusive), as if interrupting each other. The productivity of these machines is determined by the total time of transport and technological movements. An increase in productivity requires a reduction in technological, as well as transportation time and, therefore, is limited by allowable accelerations and speeds.

For a given class of machines, obviously, the high productivity economically necessary and equal for all operations is impracticable. All other properties necessary for high social productivity of labor are also absent.

The second kind of relationships between transport and technological speeds is one in which the movement of the object and its processing are implemented simultaneously. In this case, the technological function does not interrupt the transportation of the object which becomes continuous. Dynamic factors cease to limit productivity which will then be limited only by the permissible technological speed. The productivity level for machines of this class is higher and the possibility of having similar productivity and consequently a possibility of a combination in an automatic line, is greater. This is utilized in rolling, drawing, paper-making, printing and other productions.

The third kind of relationship between transport and technological functions of machines is the independence of the speed of the movement of the transport from technological factors. Processing is done in combined movements of intermediate products and tools, located on some closed transportation devices. The productivity of such machines is determined by the distance between what is being processed in the flow line and the freely selected transport speed, not limited by dynamic or technological factors.

Such (rotary and rotary-conveyor) machines are, by virtue of their fundamental properties, organic components of automatic lines.

There is, however, a fourth kind of relationship between transportation and technological functions--the independence of technological functions. The independence of technological functions is provided not only with respect to speed, but also with respect to the density and cross section of the flow of what is being processed, a higher productivity is achieved and, of course, the possibility of having equal productivity in all operations and arrangements of automatic lines.

Various classes of equipment correspond to certain stages of the development of machines.

The first were machines in which machining was done with stationary intermediate products. Later, there appeared equipment that performed the necessary operations in the process of transporting the object with respect to the drawing and rolling tool of the machine.

The age of machines in which machining was done in the course of continuous combined transportation of the intermediate products and tools is less than 100 years, while serious steps for their development were taken only in the last several decades. The same can be said of machines with mass transportation of machined objects.

This sequence is not accidental. It is due, on one hand, to the expansion of general technical, power and material means and, on the other hand, to the development of the technological processes themselves., i.e., the methods of acting on what was to be processed.

Equipment and Technology

The nature of the interaction between the tools and the object to be processed, i.e., their very essence, determines the radical differences in all the properties of technological processes and, in the final result, the potential possibilities of their implementation by machines.

Point interaction between the tool and the object to be processed stipulates the necessity of treating the entire processed surface by the working point of the tool. The trajectory of the working movement is determined, therefore, by the shape of the machined surface and is spatial, i.e., kinematically the most complicated one, different for each machined surface and quite

long. The intermediate product and the tool must be rigidly secured and, therefore, require a check of their mutual positions directly on the machine. The automation of all those functions is impossible in the general case.

Only the lowest degree of mechanization is possible for such processes, namely by the machine performing its own technological movement. Processes of this class require a stationary position for processing the object which is stipulated by, in particular, the necessity of direct participation by man. A class of machines, characterized by the contradiction between the transport and technological functions corresponds to these kinds of processes. Here, it is impossible to use machines of the second and fourth class, while the use of machines of the third class is extremely limited.

In technological processes, characterized by the linear action of the tool on the machined object, the trajectory of the working motion is determined by the geometrical guide of the machined surface. It may be a plane or a straight line, therefore kinematically more simple and short. Only for this class of processes is there a possibility for machining by the transport movement along the geometrical guide, i.e., transition of machines of the second class (rolling mills, paper-making and continuous printing machines).

In technological processes, characterized by the surface action of the tool, the trajectory of the working movement is determined by the axis of the machined surface, becomes practically a straight line, kinematically the simplest, and the same for all kinds of surfaces. All sizes and shapes of machined objects are determined only by the tool, which makes it possible to make its final check outside the machine and its automatic change. By virtue of these differences, as well as in connection with the possibility of eliminating the need for human participation in performing the operations, conditions are provided for changing over to machines that perform technological operations in the process of the continuous combined transport of machined objects and tools.

It may easily be seen that the changeover from one class of processes to another becomes possible by means of the expansion of technological material-power, i.e., by increasing available forces, temperatures, mechanical strength, thermal and chemical durability of the tool, and the use of machined materials with new technological properties.

The general direction in the development of technological equipment is a changeover from machines, characterized by the contradiction between transport and technological functions to machines that have combined them and with partial or full independence.

Area of Application

The actual problem of today is to change over to machines of the third class, especially, where corresponding processes are utilized. The top priority area for their application is very broad.

About a million presses, serviced by two million men, are used in the country in metal die forging alone. Several hundred thousands of men are employed in various kinds of casting productions, about 100,000 in manufacturing plastic parts and the same number in rubber; not less than a million men are employed in manufacturing parts from metal-ceramics, glass, porcelain, glazed pottery, crystal, cement and asbestos-cement.

The same applies to a greater part of the meat-milk and food industry, particularly, to bread-making, canning and confectionery industries. One cannot do without assembling, crating and packing in the most varied industrial sectors.

In all the enumerated production facilities, the use of human labor is at present an anachronism, by virtue of the very nature of the operations, maintained as a result of a conflict between the development levels of technology and machines. In other words, machines of the first class are still used for the process of the third and fourth classes. It is precisely here that labor became most unattractive.

Production facilities, using the processes of the third class, as a rule, are characterized by the large quantity of one type of product, whose requirements are sufficient for the repayment of the costs of operating machines in automatic lines. This is especially characteristic for the output of consumer goods.

Frequently, however, in the production of such products (grocery, haberdashery, shoes), as well as the means of production for mass output for some particular purpose (for example, die forgings, plastic parts, bearings, resistors, electrodes, basic machine parts) a large variety of products is required, each of which is individually not enough to provide an economically necessary productivity. For example, in most large metal die forging shops for a total program in the order of 100 million die forgings a year, about 1000 different products are manufactured, 100,000 each on the average per year, which is dozens of times fewer than necessary to provide economically justified productivity.

The problem of an insufficient quantity of one kind, usually considered a factor that limits the wider use of automated production can have an essentially new solution by using the properties of rotary-conveyor machines and lines. They make possible the simultaneous production of tens and hundreds of different products, providing a uniform output of each one of them and fully eliminating frequent readjustments -- the main reason for idle times in multiproduct production facilities. The readjustment, when changing over to a new product in the rotor-conveyor machines, may be reduced to an automatic change of tools or carriers, i.e., ideally, without stopping normal work.

Ways for Introduction

A year ago, the Politburo of the CPSU Central Committee considered the question of introducing automatic rotary and rotary-conveyor lines into the national economy. It was stressed that the wide introduction of such equipment would

make it possible to raise the intensification level of industrial production. It would increase the productivity of labor, considerably reduce production areas, free a large number of personnel and improve working conditions. The experience of using rotary and rotary-conveyor lines confirms the excellent results of their application and the necessity of actively introducing them in die forging, casting and metal product productions, in a number of sectors of machinebuilding and the chemical and food industries.

Taking into account the high economic yield and social effect of using this progressive kind of equipment, the Politburo instructed the USSR Gosplan, the USSR State Committee on Science and Technology, the USSR Academy of Sciences and respective ministries and departments to develop tasks on its introduction in production.

Machines of the third class save labor at the price of minimal one-time costs. Replacement of automatic presses by rotary lines requires only 6000 to 7000 rubles to free one man.

The main result of changing to machines of the third class is an increase in the productivity of social labor. Replacement of automated presses by rotary lines increased this indicator from 7000 to 8000 operations per ruble of total costs to 80,000-90,000 operations. Rotary-conveyor lines increase this indicator to 300,000 to 500,000 operations per ruble of total costs.

A great amount of design-technological and production work must be done. It is entirely realistic to perform this work on compressed schedules.

The situation is this: for rotary-conveyor machines (RKM) and lines (ARKL) there is an exceptionally great use of standard units. Service rotors that move the tools remain the same for any operations of its class, from die forging metal parts, pressing plastics, assembling electrical equipment units and products or packing meat-milk products.

The range of cross sectional dimensions, within which the basic bulk of the machined objects are contained, can be spanned by ten sizes (along the pitch between positions) of the service rotors in three-four variations (according to the number of positions and the value of the working stroke). Taking into account various technological purposes (force, monitoring, thermal), the entire set of service rotors will not exceed 300 to 400 modifications. The same number of type-sizes is also sufficient for tool conveyors.

It should be stressed that with the availiabilty of rotary-conveyor operational machines, their combination in the required number and sequence is reduced to purely installation work, available to any enterprise.

It is necessary to develop simultaneously the creation of the most important type-sizes of rotary-conveyor machines for all basic technological purposes. If, as shown by experience, a group of 10 to 15 designers is required to develop an operational RKM, then 10,000 to 15,000 designers will be required to develop the entire series. To equip these machines with tools and carriers

for the entire list of products to be processed it will be necessary to engage a 5 to 10-fold greater number of technologists and designers for the RKL. However, this represents only 2 to 3 percent of the engineering-technician cadres of each industrial sector.

As far as the production capacities are concerned for manufacturing experimental prototypes and, especially, the following output of the ARKL, it is advisable to switch over to this gradually a part of the enterprises involved in manufacturing the equipment which is to be replaced.

As we can see, all conditions are available for solving this problem.

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NEW DEVELOPMENTS IN HOT STAMPING TECHNOLOGY NOTED

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 4, Apr 84 p 15-16

[Article by A.I. Tselikov and Ye. P. Unksov: "On Improving Press-Forging Machines"]

[Abstract] A sharp growth in the technological sophistication of machinery was supposed to lead to less imports and greater export of Soviet machinery and improve the efficiency of Soviet industry. New machinery was supposed to reduce manpower needs and the consumption of metal and other materials through the creation of more efficient, reliable and long-lasting designs and the development and introduction of low-waste and waste-free technology. Soviet construction press-forging and rolling machinery achieved great successes in creating high-efficiency blank-producing equipment. After receiving heavy-duty mechanical presses, the Voronezh Production Association created a series of automated lines and complexes that could perform various metal-working processes and over the last 10 years manufactured about 5000 units of new equipment. In their technological uses, design, ease of operation and technological sophistication, the new Soviet designs for heavy-duty and unique mechanical presses, lines and complexes were better than those produced by leading American, West German and Japanese firms and was exported to many capitalist countries, socialist and developing countries. The Soviet Union created unique processes for the production of forgings and sections by heavy-duty 750-MN vertical and 200-MN horizontal hydraulic presses. Unique presses for sheet-metal stamping and synthesis of super-hard materials were created and wheels for railway rolling stock were manufactured using Soviet-made high-output unique machinery for screw rolling and helical rolling of round periodical sections, wheels, spheres and other parts. Two plants produced wagon axles by rolling them instead of forging them with hydraulic presses and reduced metal content by about 80 kg per unit. Other examples of pressure working of metals were introduced but the quality of produced machinery still did not satisfy the national economy's growth needs. There were also still too few new technological processes for pressure working of metals and it was only new computerized low- or no-waste processes that could sharply reduce labor-intensiveness and consumption of energy and materials. New high-efficiency technological processes such as isothermal stamping and pressing, use of powdered metals and continuous manufacture of parts on rolling lathes to replace stamping and other such processes were too slowly being introduced because of a lack of specialized equipment and insufficient operating quality.

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WHOLESALE PRICES, SURCHARGES AS INCENTIVES IN MACHINEBUILDING

Moscow STANDARTY I KACHESTVO in Russian No 9, 1985 pp 54-56

[Article by V. F. Afanasyev, USSR Goskomtsen [State Committee for Prices]):
"On Stimulating Product Quality Improvement in Machinebuilding Through Prices"]

[Text] Constant improvement in product quality, as manifested in updating or modernization, the creation of more-productive machinery and equipment at a high technical level and of progressive types of raw and other materials, improvement in the consumer features of items, and also the withdrawal of obsolete equipment from production, is a necessary condition for improvement in the effectiveness of social production. In the final analysis, a high technical level and good quality ensure increased effectiveness of the national economy due to the use of new equipment, lower expenditures on its production, and, consequently, resources saved and better product competitiveness in the foreign market.

An analysis of the national economic development plan for 1984 and the first four years of the current five-year plan shows definite positive trends toward improvement in product quality: the technical level of the items released is rising, plan fulfillment in terms of growth in the proportion of output in the highest quality category among all commodity output of industry is exceeding the five-year plan assignments (16.3 percent in 1984, as against a planned 16.0 percent), and so on. The level of mastery of series production of new types of machinery, equipment, instruments and materials has risen. Since the start of the five year plan, the national economy as a whole has mastered and begun releasing about 15,000 new types of industrial output. The 1985 plan anticipates mastering upwards of 4,000 new items of output and replacing about 2,500 obsolete ones. Demands as to level of production outlays have increased significantly. Industrial output net cost in 1985 must be reduced by 0.8 percent, permitting a savings of about five billion rubles in material and labor expenditures.

However, questions of improving product quality have still not been positively resolved in the national economy as a whole. Individual ministries consistently fail to carry out established plans for developing science and technology and for mastering the release of new types of output, which delays modernization. The proportion of output being mastered for the first time is decreasing. Few fundamentally new items are being mastered. A significant portion of the equipment being designed does not differ in its technical-economic parameters from

that previously released and is essentially a modernization of it. The proportion of output which has long been in production is increasing. The inadequate rate of expansion of production capacity renovation and modernization is delaying the introduction and production of output of high quality at a high technical level.

The necessity of improving output quality makes ever increasing demands on the national economy and on its management system, including price formation. In recent years, a number of practical steps have been taken in price formation to ensure conditions for the fastest possible mastering of new equipment and withdrawing obsolete equipment from production by strengthening the impact of wholesale prices, surcharges and discounts (especially for accelerating the withdrawal of obsolete equipment from production). Procedures for determining the level and methods of setting wholesale prices and incentive surcharges on them to create economic conditions more favorable to the mastering of new output at a high technical level and of high quality (including output manufactured to replace imports) are being improved. Additional steps to strengthen the role of prices are aimed at increasing the interest of manufacturing enterprises in producing highly effective new products.

Wholesale prices for new products are set on the basis of:

national economic impact of their production and use, with consideration of productivity, energy intensiveness, service life and expenditures on servicing them;

planned net cost in the first year of series production, deducting expenditures connected with preparing for and mastering production and subject to reimbursement, under established procedures, from the unified science and technology development fund;

planned profitability established for the manufacturing enterprise for the production mastering year, but not below the normative level. When setting wholesale prices for modernized or new machinebuilding output, profit must be retained at a level equal to that achieved when producing the output being replaced.

Moreover, incentive surcharges of up to 30 percent of the wholesale price (up to 50-70 percent of the economic impact) are approved for wholesale prices for highly effective new output which is not inferior to the best domestic and foreign models in terms of its parameters.

In 1984, the USSR Goskomtsen approved 6,300 wholesale prices submitted by appropriate ministries for new and modernized machinery, equipment and instruments. About half (48.1 percent) of the total number of products being mastered were at the level of the best domestic and foreign models or were superior to them in terms of technical-economic indicators, that is, met the demands of the highest quality category. Incentive surcharges based on national economic effectiveness were approved for these products.

Wholesale prices for new equipment are set on the basis of economically substantiated (normative) expenditures, with consideration of technical level, quality and economic effectiveness. Their amount is set within the effectiveness of the new equipment, with consideration of recompensing all normative expenditures on its manufacture in the first year of series production and to ensure a profitability not below that set in the plan for the enterprise as a

whole or for the output being replaced. Thus, a wholesale price of 1.35 million rubles was set for the UPG-60/160 unit-type steam generator (Ministry of Chemical and Petroleum Machinebuilding) mastered in 1984, given a net cost of production of 997,900 rubles, that is, with a profitability of 35.3 percent. Moreover, an incentive surcharge of 107,000 rubles (50 percent of the production and application impact) to the wholesale price was approved with consideration of the economic effectiveness of this unit.

The very same principles of setting wholesale prices and incentive surcharges have been applied to new machinery and equipment manufactured to replace imports. Wholesale prices for individual pieces of such equipment whose initial expenditures are relatively high are set above world prices for a period of two years so that they can be reimbursed.

In a number of instances, new equipment first mastered in the USSR is for a time ineffective [low-return], due to the relatively high expenditures on its production. Wholesale prices for such equipment are set with consideration of full reimbursement of production expenditures and planned profit. As concerns incentive surcharges, however, the amounts are set within the economic impact.

With a view towards lowering expenditures on mastering the production of new output with reduced materials- and labor-intensiveness (while retaining technical-economic parameters and quality), wholesale prices are set at the price level of the equipment being replaced, that is, all the additional profit remains with the manufacturing enterprise. For output in the highest quality category, up to 50 percent of the savings due to lower net cost is taken into account in the incentive surcharge.

The very same procedure for stimulating a reduction in expenditures on mastering new equipment is also used for previously mastered output being improved on the basis of functional-cost analysis which permits choosing the most economical technical and organizational resolutions, as well as when introducing progressive technology into production and replacing traditional methods of production with newer and more economical ones (use of powders, use of automated complexes equipped with industrial robots, and others). Thus, one way of saving resources is to increase the service life of machinebuilding output. Incentive surcharges of up to 30 percent of the wholesale price may be established when progressive technology is used (lasers, spray coating, and so on) and when the service life of new items is increased. For example, tool plants of the Ministry of Instrument Making, Automation Equipment and Control Systems mastered the production of tools with wear-resistant coatings which permit at least a two-fold increase in service life. Incentive surcharges of 30 percent were established for wholesale prices on such tools (taps, countersinks, drills, hobs, cutters, gear-milling die-heads).

One of the most important directions in perfecting price formation is to improve methods of determining expenditures on manufacturing new equipment and the economic effectiveness of its production and application.

Price-formation agencies are paying increasing attention to questions of including in the normative-technical documentation indicators, norms and specifications describing the consumer features of the items and used when evaluating their

technical levels and economic effectiveness, as well as when working out prices. With a view towards increasing the responsibility of manufacturers for product quality and increasing the economic impact of product use, when setting wholesale prices and calculating incentive surcharges to them, consideration is given only to those indicators which are specified in the normative-technical documentation.

It should be noted that individual ministries and departments have been unsatisfactory in verifying and reviewing existing standards for the purpose of raising their scientific-technical level, consideration has not always been given to developing the latest achievements of science and engineering, and they have been slow to develop standards with promising indicators and norms. Many of the machines and pieces of equipment being developed do not meet the requirements of the highest quality category even in the design stage. There are still cases of ineffective equipment with high manufacturing expenditures being submitted for production.

Price-formation agencies are constantly taking steps to carefully verify the economic substantiation of wholesale prices, to eliminate from the net cost of a product nonproductive expenses and losses or unjustified expenditures resulting from failure to meet planned (normative) schedules for mastering planned technology, to eliminate overstated expenditure norms for raw and other materials, fuel, energy and labor. Careful attention is paid to assignments on labor productivity growth and improving the use of fixed assets and circulating capital, to lowering material expenditure norms and increasing the metal use factor. Using the results of checks and expert appraisals of wholesale price plans, about 30 percent of the prices have been adjusted downward (by 10-15 percent or more). The reduction in price drafts has been even greater for individual groups of products.

There are substantial shortcomings in the existing practice of having the ministries determine the economic effectiveness of producing and using new equipment. An analysis of the materials shows that the economic impact as calculated by the manufacturing ministries, with the concurrence of the consumers, turns out to have been overstated by 30-50 percent. Moreover, ministries which represent products as new and submit incentive surcharges for approval have, in individual instances, re-approved the normative-technical documentation without changes in product parameters. In these instances, the current prices are retained, but the incentive surcharges on them are not approved.

Ministries, enterprises and planners pay little attention to designing and releasing new output with lower production expenditures (as compared with a base product). In individual instances, expenditures grow faster than the effectiveness of the new output. Under these conditions, price-formation agencies are forced to set new equipment prices only within the increase in economic effectiveness.

Low material expenditure factors have a particularly unsatisfactory effect on the new cost of new equipment and on lowering effectiveness. The machinebuilding ministries are not developing or including in the normative-technical documentation indicators of specific metals-intensiveness per units of technical parameter. In this connection, we still encounter instances of the development

of new equipment with high metals-intensiveness as compared with the best domestic and foreign models.

In order to evaluate the economic and social appropriateness of developing new output with prescribed technical-economic parameters, to limit the growth of expenditures on its production and ensure a relative reduction in cost per unit of useful final impact, we anticipate setting price limits which will be calculated by planning stage and shaped with consideration of planned expenditures and profit. Such a method of calculating price limits not only provides continuity in setting wholesale and maximum prices, but also permits establishing even during the planning stage the economic effectiveness which the new equipment will provide the national economy. And this signifies that there will be an opportunity, even at the planning stage, to determine the amount of incentive surcharges as a function of economic impact and the deduction to the economic incentives funds of the creators of the new equipment from the total of such surcharges.

Stimulating product quality improvement presupposes, along with establishment of incentive surcharges to wholesale prices for highly effective new output, the use of economic sanctions [fines] for obsolete equipment. These steps are being carried out by using discounts from wholesale prices for output subject to withdrawal from production.

Expanding the use of wholesale price discounts for obsolete output must be increased as machinery and equipment is certified, with consideration of the new and higher demands made on evaluating their technical levels and quality. It has been established that discounts of 30 percent of the price must be used for obsolete output not certified in the highest or first quality category; these discounts are transferred to budget revenues. They are not taken into account in the plan, but are used as economic sanctions against enterprises producing obsolete output.

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SCOPE, TIME FRAME OF INDUSTRY MODERNIZATION DRIVE CONSIDERED

Moscow KOMMUNIST VOORUZHENNYKH SIL in Russian No 15, Aug 85 pp 38-42

[Interview with Nikolay Nikolayevich Spiridonov, director of the Mashinostroyeniye Pavilion, by KOMMUNIST VOORUZHENNYKH SIL correspondent; date and place not specified: "The Heart of Scientific and Technical Progress"]

[Text] Guided by the experience of socialist construction, the achievements of Soviet economic system and the scientific development of the party's strategy, the April (1985) CPSU Central Committee Plenum formulated a concept of further acceleration of the country's social and economic development based on scientific and technical progress. Implementing the directions and decisions of the Plenum, the Party Central Committee held a conference on questions of accelerating scientific and technical progress at which CPSU Central Committee General Secretary M. S. Gorbachev presented a report "The Fundamental Question of the Party's Economic Policy."

The main thing now, at a qualitatively new stage of our society's development, is to carry out a rapid transition from extensive to intensive methods of managing the national economy, and find and put into action all reserves for increasing production efficiency--such are the directions of the Leninist party. As was pointed out at the conference, the key role in carrying out this global task belongs to machine building.

These days, quite a few exhibits and expositions are on display at the USSR VDNKh (Exhibition of USSR National Economic Achievements), telling about the scientific and technical progress in various sectors of the national economy. Our correspondent met with the director of the Mashinostroyeniye Pavilion, N. N. Spiridonov, and asked him to answer a number of questions.

[Question] Nikolay Nikolayevich, the predominant, key role in carrying out a scientific and technical revolution belongs to machine building. Why is this?

[Answer] Today, its influence on renewing of the country's basic production assets, on re-equipping all sectors of the economy, and on intensifying the process of full mechanization and automation is increasing as never before. It is precisely machine building that directly creates the conditions for an increase in the volume of production output and a multiple increase in labor productivity without using additional manpower.

Now USSR machine building is second in the world in overall production output and first in the output of a number of types of equipment and machines. At the same time, as was noted at the April (1985) CPSU Central Committee Plenum and the conference in the Party Central Committee, the need to accelerate the country's economic development and life itself demand much more from us--a large-scale transition to fundamentally new manufacturing systems, and the introduction of subsequent generations of machines. And this process must not proceed sluggishly, as has often been the case up to now. The party is specific in its instructions: the percentage of outdated fixed capital replacement, especially its active portion, must be doubled. It is not just any production renewal that is needed, but just that which is accompanied by an introduction of advanced technology and yields the highest economic and social effect. The decisive role here belongs to machine building. All this confirms that it is necessary to give priority to its qualitative and rapid improvement and, already in the 12th Five-Year Plan, accelerate the growth rate of the sector by 1.5-2-fold. You see, an upsurge in Soviet machine building is the main direction of our development.

[Question] How is the process of developing reliable and general-purpose machine and fundamentally new means of production reflected in the USSR VDNKh Mashinostroyeniye Pavilion?

[Answer] Without exaggeration, I will say that it is the central theme. In organizing and conducting the exhibits, we give foremost attention to exposing the process of implementing certain comprehensive and scientific-technical programs in machine building, and to showing what new production lines, complexes, systems, machine tools, machinery, instruments and equipment can be used to achieve the highest labor productivity and a reduction in production costs. All our exhibits and expositions in the pavilion are conducted along the following basic directions: development of scientific and technical progress in machine building; creative initiative of workers, industrial innovators, inventors and efficiency experts; work experience of leading collectives of the sector--winners of the All-Union Socialist Competition; showing machine building products subject to certification for the highest quality category. Whereas in 1984 there were 20 exhibits and expositions in our pavilion, 3 intersectorial (2 of them continuously operating), 12 theme exhibits, 4 expositions and 1 mobile exhibit, this year there will be more of them. Now we are preparing to conduct them more thoroughly, taking into account the increased interests and requirements on the part of the visitors. What have we been demonstrating in the summer and fall of 1985?

The intersectorial exhibit "Industrial Robots and Robotized Production Complexes" is stimulating the interest of those visiting the exhibit. It tells about the latest achievements in casting, forging and pressing,

stamping, and assembly production; organizing and conducting machining, materials handling and warehouse work; building the newest electroplating and paint and varnish equipment; and incorporating automatic manipulators in agriculture. Sixty-five exhibits here are operating. The exhibit guides and representatives of the manufacturing organizations not only demonstrate them in operation, but also give visitors the necessary explanations. I would note that quite a few service members visit this exhibit every day.

Also worthy of the attention of those visiting the exhibits are our expositions such as "Achievements of Optical-Mechanical Information in the Machine Tool and Tool Industry"and "The Rubin Production Association--The Leading Enterprise of the Optics Industry." The intersectorial exhibit "Achievements and Advanced Methods of Protecting Metal and Metal Items from Corrosion," in which 404 full-scale exhibits are represented, is successful. Recently, the exhibit "Kriogenika-85" opened in the pavilion. It has a wide representation of promising models of a variety of domestic cryogenic equipment used to achieve extremely low temperatures. Specialists of the country's enterprises and organizations, scientific research institutes and inventors show a great deal of interest in it.

In July, the exhibit "Attestatsiya-85" was opened at our pavilion, telling about the advanced work experience of Dnepropetrovsk Oblast enterprises on increasing production efficiency and social development based on certification and improvement of work places. Another new, thematic exhibit deals well with the experience of the best production associations, enterprises and organization of the Ministry of Machine Tool and Tool Building Industry on automation and mechanization of production. Now, when the output of the newest automated equipment, machine tools and machines with numerical control, industrial robots, mini- and micro-computers is increasing in the sector and retraining of personnel is ongoing, it is simply hard to overestimate their importance.

[Question] At the April (1985) Party Central Committee Plenum and the conference in the CPSU Central Committee on questions of accelerating scientific and technical progress, special attention was paid to the exceptional importance of the most rapid introduction of advanced equipment and fundamentally new manufacturing systems. Please give us more details about their capabilities and operating peculiarities.

[Answer] Today, automation of the basic manufacturing processes in large-series and mass production (motor vehicles, tractors, agricultural machinery, tools, general equipment) has reached a comparatively high level. But here is the problem: This production does not lend itself to readjustment. As a result, the existing automatic lathes and automatic lines here have to be almost completely replaced when it is necessary to switch to production of new items. Thus, the rate of renewing product output is held up, and in a number of cases this becomes a serious obstacle to technical progress.

Here is what is important to understand and comprehend: Mass production, specialists estimate, accounts for only one-quarter of the output volume in machine building. The remaining 75 percent of the products are produce by series, small-series and custom production, where the level of automation is

much, much lower (ships, airplanes and helicopters, construction and road machines, power, chemical, metallurgical and electronic equipment, and so forth). You see, life requires more and more production efficiency and versatility. Is there a solution to this situation? Yes, there is.

Large-series, series, small-series and even custom production must be given the proper flexibility and mobility. That is, we must switch to fundamentally new means of production--flexible manufacturing systems (FMS). Then the template--the program medium in previous automatic machine tools--would give way to a punched or magnetic tape with recorded commands. Computing them, computers or numerical control machines would help move the parts or tools over the given pattern. The operator can quickly replace the punched-tape--a machine tool, an entire line or even section will be reorganized for manufacturing or machining a new product. Such units, consisting of machine tools and numerical control machines and industrial robots, have been given the name flexible manufacturing modules.

The advantages of this trend are unquestionable, and the possibilities are actually unlimited. You see, such modules can be used to create not only flexible automated lines or sections, but also shops and, finally, even automated plants. Not to mention the fact that thousands and millions of people will be freed from laborious, monotonous and uncreative labor. That is why, as was pointed out at the conference in the CPSU Central Committee, capital investments in machine building should be increased 1.8-2-fold and the volume of deliveries of modern types of equipment sharply increased.

I would note that industrial robots, automated complexes and flexible modules are widely represented today in the Mashinostroyeniye Pavilion. Flexible manufacturing systems and automated rotary assembly lines are a large and interesting section of the "Scientific and Technical Progress-85" exhibit. Incidentally, 86 ministries and departments are participating in this largest thematical exposition of the year. They selected on the latest, most promising developments for display at the VDNKh.

[Question] Where, for example, are flexible manufacturing systems already being effectively used now?

[Answer] Mainly at enterprises where machining of primarily complex base members of machines is of great importance. The "Talka-500" flexible manufacturing system manufactured by the Ivanovskiy Machine Tool Production Association imeni 50-letiye SSSR and operating there can serve as an example, which has been talked about in expositions of the USSR VDNKh. It includes several dozen of the most modern machine tools and is designed for machining up to 100 types of base members from construction materials in small-series production. All processes--from obtaining the blanks to unloading the parts--are accomplished in the automatic computer-controlled mode.

As the experience of operating these and other domestic flexible manufacturing systems shows, the productivity of numerical control machine tools in them is an average of 1.5-2-fold higher than the total productivity of the same number of units operating individually with program control. Furthermore, a significant reduction--up to 40-60 percent--in the production cycle and the

corresponding amount of unfinished manufacturing is achieved, as well as an actual freeing of machine tool operators.

On the whole, a wide assortment of components are machined on the flexible manufacturing systems in operation today, in a number of cases running as high as 250 or more types. This, of course, is not the limit. As scientific and technical progress further accelerates and intensifies in the country, the product mix machined on such fundamentally new production systems will grow rapidly.

[Question] But why haven't such universal, flexible manufacturing systems found widespread use up until now?

[Answer] Primarily, because the development and introduction of FMS is not a simple matter. It required not only specific achievements in the field of automation and robotics, but also the availability of vast engineering and technical and production resources. Judge for yourself: This involves a basic replacement of the existing fleet of machines. Now we have come to this point.

In addition, the new always opens the way in a struggle with the old, and encounters resistance. Therefore, let us say frankly, the lack of understanding of the unusual characteristics and capabilities of such high-class machines initially was also a definite impediment to progress. You see, the capability itself of manufacturing different components on one flexible production line was to many, most likely, a thing of the future, and not an urgent task of today's machine building. A radical change was needed in the thinking of a large number of scientific and engineering personnel.

[Question] That is interesting, but what are the time intervals today between a certain invention in machine building, its interpretation, and series production?

[Answer] I will use the following examples to answer this question. Not long ago, a working exhibit was set up in our pavilion--a conveyer-transfer complex, built using the MAK-2-320 manipulator and a materials conveyer controlled by a micro-computer. The prototype was made in 1984. The complex makes it possible to completely automate the process of transferring and returning the materials to the production line. The annual savings from its use is 31,400 rubles. Specialists of the sector and pavilion visitors look over this exhibit with interest. Series production of it begins this year.

Engineers, workers, students, vocational and technical school students, and service members linger for a considerable time at another of our novelties--an operating welding station based on an industrial robot. The developer and manufacturer is the motor vehicle plant in the city of Tolyatti. The station is designed for complete automation of manual labor in welding operations of the VAZ-2108 automobile body. Series production of it has already begun.

In this regard, one can also mention the automated forging complex with an electronic control system (the annual savings from its incorporation is 230,000 rubles), the 2S42-65 numerical control device (annual savings of

14,100 rubles), the micro-computer numerical control Iskra-2.5 PL industrial robot for plasma cutting (annual savings of 54,500 rubles) and dozens of other exhibits of our pavilion. In general, it takes 1-1 1/2 years from development of a prototype to the beginning of small series production. But this time period is adhered to only with the most favorable activities of developers and maximum interest of the customers themselves. Is it too long? Let us look at the statistics.

It took mankind about 1,000 years to go from the development of a specialized tool to the machine, and only 100 years to go from development of the machine to partial automation of production. Over half a century passed from the invention of the telephone to its use. For the radio this period lasted 35 years, 31 years for the electric light bulb, 15 years for radar, and only 3 years for the transistor.

It seems that the latter time period is not too great. Nevertheless, under conditions of scientific and technical progress it must be decreased even more. There is no other way. You see, machine building has been given immense tasks. Judge for yourself: Today in our country there are more than 50 flexible manufacturing systems of various production profiles. In the next few years there are plans to manufacture and put into operation more than 30,000 flexible modules of various purposes and profiles, and 1,800 flexible manufacturing systems. By the end of the 12th Five-Year Plan, the number of numerical control machine tools must be more than doubled. There are plans to manufacture more than 100,000 industrial robots in this same time. An accelerated transition to flexible and mobile production and maximum utilization of existing capacities is needed not for itself. The successful completion of the economic tasks of developed socialism, further improvement of the national well-being, and the strengthening of our Motherland's defensive capabilities depend to a decisive extent on it.

[Question] Such a radical revolution in machine building, of course, is inconceivable without a great intensification of the work to improve vocational training and retraining of the sector's specialists. Obviously, the staff members of your pavilion are taking part in this?

[Answer] Yes, that's right. Along with popularizing achievements, we are becoming more and more active in the process of retraining personnel. This work is being done in several directions. Firstly, the ministries concerned conduct technical seminars on the most important questions on the basis of our exhibits and expositions. Let's say, on the introduction and use in production of industrial robots, numerical control machine tools, flexible manufacturing modules, flexible manufacturing systems and so forth. Their participants gladly make use of our reference center and film library, familiarize themselves with the most interesting operating exhibits, and receive brochures on certain equipment. Secondly, we receive and accommodate specialized excursion groups on 5-day trips to the USSR VDNKh. As a rule, they include associates of scientific research institutes, engineers, technicians, workers and students given these trips as incentives for successes in socialist competition. Thirdly, upon request the pavilion conducts group or individual visitor consultations, including for inventors and innovators. I would note that members of the Army and Navy account for a

good deal of the consultations and planned excursions. As a result of such an approach, not only is the outlook expanded, but also the technical knowledge of visitors to the Mashinostroyeniye Pavilion broadened.

The following figures indicate the scale of our work: In 1984 (just within the limits of the directions listed above), 1.94 million people visited the pavilion. More than 614,000 people have already visited the pavilion during the first 4 months of this year.

[Question] In conclusion, Nikolay Nikolayevich, our traditional question: Is the independent creative work of soldier-innovators helping to resolve certain problems of scientific and technical progress?

[Answer] Without a doubt. You see, skilled workers of the army are conducting a creative search in a broad range. This is helped by the extent the USSR Armed Forces is equipped with not only the most modern, but also exceptionally diverse equipment. Striving to keep it in top shape, operate it as best they can, repair it more qualitatively, and achieve a substantial savings in spare parts and fuel and lubricants, innovative soldiers often find interesting technical solutions, and devise fundamentally new devices, instruments and assemblies which have a significant effect. Now and then, local inventions, subsequently, are used on a rather wide scale in various sectors of the national economy, including machine building.

The results of the creative work of the skilled workers of the Army and Navy are demonstrated in various pavilions, but they are, as a rule, most widely represented at our annual exhibits of the scientific and technical creativity of young people. Thousands of such inventors' works have been exhibited at them in recent years. Hundreds of officers, warrant officers, non-commissioned officer and petty officers, soldiers and sailors have been awarded medals of the USSR VDNKh.

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SOVIET PRESS TECHNOLOGY CLAIMED TO BE AMONG WORLD'S BEST

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[Article by Yu. N. Veremeyevich, General Director of the VNIITmash Scientific Production Association, and Yu. A. Sinitsyn: "Current Status and Tasks Facing the Ministry of Tractor and Agricultural Machine Building in Raising the Technical Level of Heat-Stamp Press Production"]

[Abstract] The Ministry of Agricultural Machinery's heat-stamping process was one of the most advanced processes in Soviet industry and was responsible for more than 20 percent of the industrial output of stamped forgings. Forgeries operated more than 200 automatic and aggregate-mechanized lines and automated and semi-automated units for producing industrial-quality forgings. About 62 percent of the metal-forming equipment used by industry was cranking machinery such as heat-stamp presses and horizontal forges. Advanced technological processes such as heat extrusion, forge-rolling, helical rolling, radial uncoiling and rolling of various machine parts were also used. The heat-stamping industry's tasks for 1983-1990 were supposed to be achieved by reconstruction and re-equipping of their existing foundries through the widespread introduction of new technologies and equipment, robotics, specialized equipment and automated lines. The first experimental models of automated hopper loaders were successfully operated at several factories and plans were set to introduce these devices at other plants. Fuel-oil burners and automated pneumatic heating regulators for foundry furnaces were being used to save fuel. A process for profile-shaping stamp blanks was more highly developed. The use of helical rolling to profile blanks and save rolled metal began to be used. New automated higher-output rollers were developed to form 10-90 mm blanks under a completely automated process. These rollers were successfully used at several plants and their mass production was organized. The production of hopper blank loaders and automated rollers made it possible to form automated heat-stamping lines. Work was carried out to create and introduce specialized lines for manufacturing different agricultural machinery parts. Extrusion stamping was one advancement in the production of stamped forgings. Heat extrusion was found to reduce metal consumption by 40 percent and the labor intensiveness of metal working by 20-25 percent. It was found that the use of heat extrusion processes could be expanded by the introduction of special fittings for all-purpose presses and by adapting specialized presses for joint-matrix stamping. Low-waste technological processes began to be used to reduce metal consumption by 10-15 percent, labor-intensiveness by 20-40 percent and tolerance ranges by 50 percent. Helical rolling was found to be one of the most effective processes for manufacturing blanks for multidiameter shafts and automated two-shaft helical rollers were introduced at a series of plants to conserve metal and increase efficiency.

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PLANT SELF-MANAGEMENT EXPERIMENT RAISES PRODUCTIVITY

Moscow TRUD in Russian 20 Sep 85 p 2

[Article by M. Shcherbachenko (Sumy): "Advantageous to the State, Advantageous to Us"]

> [Text] Six of the 22,000 Sumy machine builders are the chief of the welding laboratory G. Shelenkov, the deputy general director for economic problems V. Moskalenko, the brigade leader V. Marchenko, the general director of the association V. Lukyanenko, and the fitter-installers I. Yunak and A. Uvarov. Each of them is passionately involved in his work and each has found his own place in the large project of accelerating the intensification of production. All of them are actively assimilating new methods of management and extensively taking advantage of the rights of the labor collective for strengthening the enterprise's economy and solving social problems. Now they like all workers of the association are participating in the experiment which will be discussed in the article below.

Tension in the Chain

The goal has been clearly marked: On 1 January 1985 the Sumy Machine-Building Association changed over to self-financing. Formerly the changeover for Mally took place in a single hour. But in actuality?

Perhaps it began when they began to study the loading of the production capacities of the sections, shifts and shops, when the workers began to master the servicing of more than one machine tool, when they measured how best to place the equipment and in general did everything so that the capacities would produce as much as possible. The story begins 10 years ago. But this is only the result; one must look for the cause somewhat earlier.

Perhaps it is hidden in those years when the Sumy workers were called jewelers--they always fulfilled the plan by precisely 101 percent. Was it not then that the idea germinated in the collective: "Perhaps this is enough self-deceit? We are bored with working at half-force!"

Brigade leader A. Golik: "We have been working under the conditions of the economic experiment--our Sumy experiment which is different from the large-scale one--for a half year. But sometimes it seems that it has been half a lifetime. We began to move toward the present policy long ago." V. Zhukov, chairman of the association's trade union committee: "One can say to a worker: 'Starting today you are the master. Assume your rights.' But the individual does not know what to do with these rights. One does not become a master immediately, one needs time...."

What? Where is its beginning? V. Lukyanenko, general director of the association: "Regardless of how universal the economic mechanism may be, in the final analysis everything is decided by people, the collective. And the collective needs confidence."

If Vladimir Matveyevich Lukyanenko, right after he had become head of the machine building plant (the Sumy Machine-Building Scientific Production Association imeni M. V. Frunze--acronym--SMNPO--appeared later on the basis of this plan) had immediately begun to publicize the idea of cost accounting [khozraschet] among the workers his response would have been: "How can you talk to us about profit when everywhere around us there are shortages? Housing is not being constructed, there are not enough kindergartens, the machine tools are outdated and there is nowhere to rest."

"At that time I said to myself: 'First achieve their confidence; this is an indispensable condition.' I enlisted my deputies and the shop chiefs to lay the foundation for a residential building," recalled Lukyanenko in our conversation. "We did not have an excavator and they worked with picks and shovels. This was the first step."

People do not immediately believe in the sincerity of such acts on the part of managers. They began to believe Vladimir Matveyevich when after the first building there followed others, when they began to construct recreation bases, and Lukyanenko himself dug up the first tree stump (and, judging from his outstanding physical data, I do not think that during the night they had loosened this stump in order to make the director look good). Such acts were not a trap for simpletons since the simpletons had been transferred nor was there any democratism for show, which inevitably reveals its true colors. For Lukyanenko who had traveled that path from foreman to director at this plant for all of the workers to see, this was a natural style of work which presupposed everyone's participation in the common cause.

They say that each collective has the boss it deserves. Following this logic, if the manager is good (and in the SMNPO the "general"--this is what they call the general director--by general recognition is suitable), consequently, the collective is also good. And there is proof of this. The association is considered to be the best in the branch and it approximately doubles the average branch norms for increasing volumes and labor productivity. It fulfilled the five-year plan in 4 years and 7 months and more than 60 percent of its products are produced with the State Emblem of Quality. One fragment from the life of the SMNPO: when the U.S. president imposed an embargo on the delivery of gas-pumping equipment for the Urengoy-Pomary-Uzhgorod gas line the

Sumy machine builders manufactured this equipment in the shortest possible periods of time and with excellent quality. This is the kind of collective we are talking about.

Having discussed the past let us turn to the future. Recently the Frunze machine builders adopted socialist commitments for the 12th Five-Year Plan. Here are some of their positions:

to manufacture 30 million rubles' worth of products in excess of the control assignments for the five-year plan; to surpass the established assignment for increasing labor productivity by 2.5 percent;

to double the production of goods for cultural and domestic purposes.

Why precisely these figures? And what are they--perhaps they are simply tiny little pluses to the plan?

"We do not have tiny little pluses, we recognize only pluses," Zhukov plays with the word. Valeriy Vasilyevich has been a Frunze machine builder since his youth: a form setter, dispatcher, senior foreman and then trade union work. For 3 years he was elected chairman of the SMNPO trade union. "And pluses--because the adoption of commitments for us is not simply a formality, but a serious, comprehensively thought out action. Perhaps you have heard this term in the association: 'normative production capacity'?"

I had heard it and more than once. The workers had discussed how they and the economists had analyzed the possibilities of each machine tool, each brigade and section. Each day the foremen drew up reports of their breakdowns and idle time, they studied them and they worked out countermeasures. Thus they gained a precise knowledge of what the return should be with a complete load. This potential of the equipment was also declared to be the normative production capacity. In keeping with it they began to draw up planning assignments. They were no longer simply difficult, but equally difficult for each and every one, throughout the entire chain.

"And this precludes even the idea of reducing socialist commitments," explains Zhukov.

"What forms and methods are used to draw these up?"

"The traditional ones. They also work for us with the maximum loading and produce the necessary results. When control figures come for the next year they are broken down for the various production units and then there is a public defense of commitments from below to above--the brigade, section and so forth. The shop is defended in the large council for the organization of socialist competition."

"Is the council a control agency?"

"It is also an agency for assistance. For example, the workers of the 12th Shop submitted a request: tell us whether or not it is possible to save on metal if we use purchased metal blanks? Members of the council studied the

question and the administration for material and technical supply contacted the suppliers of these blanks and agreed that the tolerance would be reduced to a minimum. Then they arrived at a concrete savings."

There were many entries left on the notebook. But let us note that since this year the enthusiasm of the Sumy machine builders is based not only on solid traditions, but also on the most immediate economic need.

We Had Begun an Experiment

"Respected comrades! Since 1985 the association has been operating on the conditions of an economic experiment which is different from the general experiment which is being conducted in the branch."

Thus begins the "reminder to the worker."

"Under the conditions of the experiment the financing of expenditures for the association which are used for capital investments for technical reequipment, reconstruction and expansion of existing productions and expenditures for the development of production, science and technology, the formation of the economic incentive fund and for other social needs are made from the internal funds of the association--profit and amortization deductions which are intended for restoring fixed capital. Here the funds from the amortization fund can be used only for financing capital construction while all the other expenditures must be covered by income of the association--profit."

Let us note once again the last word--"profit"--and continue the quotation.

"Before the experiment in order to finance the aforementioned expenditures the association could obtain funds from the state budget and also from the ministry. In addition to this the ministry could take away the association's profit and use it for the needs of the branch. The volume of deductions into the budget was not known ahead of time either and was established each year by the current plan. Thus the collective of the association was not in charge of its own income."

But, by the way, what is necessary in order to become a good master? Independence. It might be the major condition, without which one will not become a master.

Since January of this year the Sumy workers have been so independent that they have been dumbfounded. They have no one to rely on except themselves. They cannot expect a single kopeck from their own ministry now. And profit as distinct from subsidy still has to be earned. The deductions into the state budget, naturally, have not been eliminated. Moreover, now these sums significantly exceed the previous amounts, and from year to year, according to the conditions of the experiment, they will increase by 1 percent. And if you end up without profit you go to the bank and ask for credit. Incidentally, the related suppliers have nothing to do with your problems; they are living according to the old laws; and even under them they can let you down. This is how dangerous independence is. Who needs this risk? Now we shall explain.

The experiment established a policy whereby the profit obtained by the association is distributed between the state budget, the ministry and the association according to normatives previously established for the various years of the five-year plan. Here is where the germ of the idea is the firm normative. Stable distribution of profit. Without this the master is not the master. Ask women who have to run their households: what is preferable when the husband brings home earnings sometimes of 100 rubles and sometimes 300 rubles, or when each time he brings home 200 rubles? The balance will probably tip in the direction of the stable incomes. Now the Sumy workers know precisely: by increasing output and raising productivity, increasing rates and so forth they will increase both the state's and their own income in a mutually advantageous way. They remove the yield guaranteed by the normative, as it were.

This year out of each ruble 26 kopecks go into the state budget, 3 kopecks--to the ministry, and the rest--that is, 71 kopecks--go for the internal needs of the SMNPO. The silver and copper coins, you understand, are monetary tokens of different values--this year the profit is planned to exceed 16 million rubles. The collective decides how this is to be distributed.

Here is an example. Many workers and employees of the association do not like the Pioneer camps where the schools send their children; the collective made a decision to construct an additional building in the association's camp. These expenditures were not envisioned previously but once the majority considered this necessary--that was all, it was the law.

During the first half-year of work under the conditions of the experiment the following took place:

as compared to the corresponding period of the preceding year:

the indicator of commercial output increased by 13 percent, and normative net output--by 15 percent;

labor productivity increased by 14 percent;

the profit which remained at the disposal of the association increased by 29.9 percent and deductions into the state budget--by 48.4 percent.

If the method of dividing up the profit had not been advantageous to the association all of these indicators would probably have dropped at once.

Expenditures and Incomes

It is good when expenditures are covered by incomes. This pertains not only to branches and enterprises, but also to each concrete worker. If a person increases labor productivity 1.5-fold and receives a miserly addition to his bonus for this, you will agree that this motivates him, as it were, in the reverse direction. The experiment has placed the Sumy workers in a position where it is necessary to steadily increase their labor activity. This means that the people must make cautious expenditures of mental and physical energy. And what are their incomes in exchange for this?

At random I went to Shop No 12 and became acquainted with the brigade of Vladimir Aleksandrovich Novikov. It has 11 operators of machine tools with numerical program control. As for expenditures, this year the work is on a much larger scale than previously. They have changed over to servicing more than one machine tool and the additional payment is 10 percent; they have learned to adjust their own machine tools--another 15 percent; they have introduced self-control and attached the brigade seal--another 10 percent. They also receive bonuses for fulfillment of the plan according to contractual deliveries, for economizing on and reducing labor-intensiveness, for high quality and new technical equipment....

I understand that words alone are inadequate. I took some excerpts from the ledgers of the economists. In July 1984 an operator of the second category A. Ilchenko received 259 rubles and in June of this year--299; I. Peston (also of the second category)--183 and 256 rubles, respectively; V. Makarchuk (fourth category)--305 and 423 rubles, respectively. This was in Novikov's brigade, and here are some entries for other brigades of the association. A fitter of the fourth category V. Grebinyuk--286 and 344 rubles, respectively; a plane operator of the third category I. Bespalyy--197 and 319 rubles, respectively; a fitter of the fifth category Yu. Safonov--372 and 475 rubles, respectively. Such are the items of income.

But we are not speaking about increasing overall earnings everywhere. The administration and the trade union committee are constantly thinking about how to utilize the impressive annual material incentive fund with the greatest productivity. "We must evaluate each person individually and not 'in chorus.' And the experiment helps us to do this." I remember well this phrase of Vladimir Petrovich Moskalenko, deputy general director for economic problems.

Previously if the shop did not fulfill the plan, the foremen, shift chiefs, shop chiefs and specialists of various services received the same bonus which consisted of 25 percent of their salaries. It is different now. One can obtain 15 percent, the same amount of 25 percent, and finally 45 percent. But why "finally"? It is quite possible not to receive a bonus at all. Everything depends on your personal contribution. In the SMNPO they have quite uncustomary things. For example, the shop has failed to fulfill the plan but the brigade receives a good monetary incentive. Tell me, is this unfair? Not at all. If a brigade has fulfilled its own assignments and even surpassed the earmarked indicators, why should the people bear material responsibility for that for which they are not responsible and can in no way be responsible--the work of the entire shop.

In May the administration and the trade union committee of the association put into effect provisions concerning the policy for establishing the personal increments to the salaries of engineering and technical personnel and the wage rates of workers. The certification commission, which includes managers of the production subdivision and its public organizations and also leading workers selects the contestants. Their number should be 2-3 times as great as the number of those for whom increments will be established--this is especially stipulated and the incentives produce a maximum effect when based on a competitive principle.

"The corresponding fund was allotted for increments for workers and specialists of our shop. But they decided not to spend it all at once, but to leave a reserve. The people must know that there are possibilities of their receiving incentives from the administration and the trade union, and this will motivate them to increase their labor output," said the chairman of the trade union committee of Shop No 10, Tatyana Dmitriyevna Lukyanenko. "And those who were declared to be most worthy were the brigade leaders Varavka, Pavlenko and Slyusar, the economists Belotserkovskaya and Priymenko, the senior engineer-technologist Zhereb and the chief of the technical bureau Kopernak. They were awarded increments at an expanded meeting of the shop trade union committee.

"Why at an 'expanded trade union committee'?" I was asked later by V. Moskalenko. We discussed increments and the topic came around to my visit to Shop No 10. "A gross error! These minutes will probably be returned for revision."

"But why?"

"The candidates must be discussed at a meeting of the labor collective of the production subdivision where the contestants work."

"You mean an expanded meeting of the shop trade union committee is not enough?"

"No. You know, this is a matter of principle. There are managers of subdivisions who behind closed doors can get the trade union on their side, even in an expanded meeting. In these cases they actually decide for themselves who should receive the rewards. It is necessary to break them of such habits and the most appropriate instrument for this is the general meeting. This is completely in the spirit of the law concerning labor collectives. Keep in mind also the fact that the awarding of increments should be an act of great educational significance.

Later Petr Vasilyevich Martynenko, the chief of the bureau for new technical equipment, told me how he and the engineer-technologist Ye. Kozhukhar and the engineer-designer D. Korolev became excited at a general meeting of the collective of the head technologist's administration. More than 100 people had gathered together to consider their candidacy. And when they unanimously approved it each of the competitors understood that the confidence and respect of the collective is an increment that is much more significant than additional money.

Highly Placed Protectors

As we already know, the success of the Sumy workers depends on the amount of profit. What is profit? The price minus the production cost. The price is fixed, so the only way of increasing profit is to reduce production costs. Progressive methods of labor organization come to assist here. In the SMNPO more and more collectives are working under a unified contract. Specialized brigades are becoming increasingly popular whereby, for instance, one brigade

performs all of the lathe operations, another--all of the milling, a third--all of the boring, and so forth. The items are turned over to the associated workers in the necessary assortment and precisely on time. Anatoliy Gennadyevich Vlasenko, the head of the comprehensive cost-accounting brigade from Shop No 22, gave this comment: "Previously every brigade leader, me included, tried to take the most advantageous orders and volumes. We elbowed our way through. Now, working according to the specialized brigade method, we have a precise list of what we must do, and we also have it in good time so that we can think about everything and prepare properly. We have begun to work more rhythmically, and the quality has improved." "And you do not have to tear your hair out as before?"--"Well, what can I say.... Sometimes I tear my hair out so as not to get behind schedule. But in general, of course, less frequently."

But the main path to reducing production costs is scientific and technical progress. Herein lie the main reserves.

The search is taking place, as it were, in all offices of the SMNPO--among the designers, technologists, economists and the All-Union Scientific Research and Design-Technological Institute of Compressor Machine Building which recently joined the association. And, of course, in the brigades as well.

The cost-accounting comprehensive brigade of Aleksandr Nikolayevich Golik is working in Machine Assembly Shop No 6. It produces centrifuges--they receive the blanks and release the fully prepared item. For a long time now the collective has been among the leading ones, and now it is working on its assignment for April 1987. The experiment has gone a long way toward encouraging workers in technical creativity.

Previously the screen for the centrifuge was put together by hand. To understand what this means let us point out that each screen had up to 100 screws, on each centrifuge there were from two to 10 screens, and the brigade had 15 types of centrifuges. In a word, screwing these screws into the screen was a tedious, time-consuming and labor-intensive business. But then they managed to adapt the screwdriver to a pneumatic drill and the work proceeded much more rapidly and easily.

We spoke with the brigade leader for a long time. I learned from him which indicators are now planned for the brigade and also many other things. To my questions about the experiment I received exhaustive answers. The chairman of the shop trade union committee, A. Vasyakov, who was present during the conversation, was proud of Golik.

"In general we have a good shop," he said. "Out of the 28 brigades 27 have already completed the five-year plan."

"Yes? Then introduce me to the 28th."

So I had a meeting with the brigade of plane operators led by Andrey Yakovlevich Guz. And here I encountered something extraordinary: the brigade leader had no idea of what the experiment was all about. He had heard that something like this was taking place--and that was all. And the fact that it

was "taking place" with him himself, it seemed, did not interest Guz at all. Simply incredible: how did he manage to do this?! For in the association every 100 meters there are stands with descriptions of the essence of the experiment, schedules and tables. After all, they have conducted meetings, sessions of the aktiv and training, reminders have been distributed.... How could this be?

The laboratory for sociology and psychology of labor conducted an investigation in the collective. The following became clear. Of those questioned 82 percent agreed that "the economic experiment is a matter of statewide importance and I am prepared to contribute to its successful implementation through my personal labor." A total of 11 percent responded: "Although I do not see any direct advantage for myself I shall participate actively in the experiment." There were 6 percent who responded: "It does not make any difference to me whether I work in the experiment or without it." And 1 percent responded: "I do not think that conducting the experiment will produce any advantage." Another variant of the response was offered: "The experiment does not interest me at all," but nobody chose this one.

In which group should we include Guz? In principle one can include him in the last percentage--zero, but this would not be scientific. In order to include him among those who considered the experiment useless he must at least have an idea of what it is. So this will not do either. There remains the variant which accounted for 6 percent of the respondents: "It makes no difference to me whether I work...." This is exactly the place to make a speech about the backward brigade leader who is holding the collective back because of his inertia. But here is the problem: Andrey Yakovlevich's brigade is working quite successfully, keeping ahead of the planned deadlines.

But how can one reconcile indifference and labor success? It is not a simple question. Unlike the sociologists I did not keep track of my conversations in the association and therefore I cannot calculate percentages. But among the several dozen workers with whom I discussed the topic that interested me there were frequently people who did not ascribe serious significance to the experiment. But they were working and they were working fairly well! Because the need to do their work well is a part of the very nature of Sumy machine builders. Even subjectively indifferent workers objectively--through their labor--support the common efforts of the collective. This is why I do not feel that I have the right to reproach them. And I believe that soon Andrey Yakovlevich Guz will take a serious interest in the economic experiment.

Here are the kinds of benefits produced by the new management methods:

the fund for social and cultural measures and housing construction now exceeds 13 million rubles, which is considerably more than last year;

in 1986 internal capital will be used to construct residential buildings with an overall area of 40,000 square meters;

four children's combines are being constructed under this five-year plan, a health complex is being prepared for relief, and a polyclinic is being constructed.

The characteristics of a master are beginning to show through (or else they are not) in various life situations. The association has opened up a new production for producing pumps for atomic electric power stations. Transferred to it from the well-arranged, reliable production of chemical equipment were the brigades of M. Mironov, V. Aboznyy, N. Balynskiy, I. Tokarev.... They were transferred, let us note, voluntarily; no one was forced to go. One asks: Why? In order to get down to the bottom of this question I literally glued myself to Ivan Semenovich Tokarev.

"Did they promise them higher wages?"

"No."

"Then were there some other benefits? An apartment, perhaps?"

"They have apartments. In the central area."

"You mean next to their former work place? And now you have to go to the edge of the city in buses?"

"It is not so bad, I leave early before the crowds form."

"But what is the reason? Were things going well for your brigade in its old place?"

"They were going all right."

"But they still brought you here? Is the work more attractive?

"Yes, the work is interesting, we have mastered automatic welding manipulators. Of course it is very responsible work. As they say, you have to keep track of the tiniest details. The technical control division for the various operations, the general technical control division, the state atomic energy supervisory agency. There is no mention of the Emblem of Quality--the products are not subject to that kind of certification; each item must be flawless. There is a great deal of tension."

"Then I understand even less. And yet the entire brigade went along with you, that is the mystery."

"What is so mysterious? Where the needle goes the thread must go too."

"We have spoken...."

The last reason remained: mass enthusiasm. And it was unadulterated enthusiasm, not reinforced by anything substantial. Although...the fact that your association begins a new and important job and asks you to help, the fact that the country is very much in need of pumps for the atomic electric power station--is this really not "substantial"? For the master's interests are equivalent to the interests of the business. In such a situation he acts

selflessly. But this is not precisely true. His selfish interest is the success of the common cause.

Any economic action and in general any economic situation has quite definite moral content. When an individual--be he a lathe operator or a "general"--has become lazy, concealing reserves and downplaying his own capabilities, planning from what has been achieved becomes amoral. In the SMNPO they are now working not from what has been achieved, but from what is achievable. And they are not concealing reserves--they are revealing them.

Incidentally, we know of cases in which the theoretically tested economic mechanism has survived in one situation and broken down in another. Because some situations have been prepared and others have not. In this case the experiment, which is directed toward revealing the qualities of the master and toward utilizing all conceivable capabilities of production as a whole and each worker individually, is taking place in a situation where they have awaited it and have prepared for it. In these places it is now being given the highest level of protection--the protection of the labor collective.

11772
CSO: 1823/8

NEW GENERATION RADIAL FORGE PRESS INSTALLED AT RYAZAN PLANT

Moscow EKONOMICHESKAYA GAZETA in Russian No 46, Nov 85 p 18

[Article by N. Kozlov (Ryazan), under the rubric "Party Organizations' Elections and Accounts": "Maintain Initiative, Increase Responsibility"]

[Text] The collective of the Ryazan "Tyazhpressmash" Production Association is getting ready to change over to manufacturing new generations of high productivity equipment. In the 12th Five-Year Plan period, for example, it will produce radial forging machines, each of which will eliminate 26 technological operations, free about 30 machine tools and, therefore, free large production areas.

Much has been done in the association to get ready for the production of these and other novelties. Yet, so far, the matter has been proceeding slowly. In November, it was planned to put in operation a thermal-trimming building, however, the equipment for it was only ordered at the end of the year. Modernization under operating conditions is always a difficult problem, but here it is also complicated by the fact that the association is not fulfilling the plan for the current five-year plan period and 1985. Lately, production, technological and labor discipline has weakened in the collective and crash-work flourishes.

All this was discussed at the report-selection party conference of the Ryazan Heavy Forge-Press Equipment Plant -- the head enterprise of the "Tyazhpressmash" Association. Conference delegates critically analyzed the style and operating methods of the party organization and the degree of communist influence on production matters. The work of subdivisions which were called upon to introduce the greatest contribution to scientific technological progress was critized sharply. Correctly named among them was the designer service headed by Communist V. Yudayev. Little initiative in the work of this engineering collective is directed toward creating, mastering and producing new machines. The development quality is poor and the drawings sent to production facilities frequently have serious errors.

There are no fewer omissions in the work of the technological service headed by Communist Yu. Bekhtin. The number of high productivity equipment in the association is growing. In the last two years alone over 1.5 million rubles were spent on it, but this equipment is utilized poorly and is not loaded fully. Idle times became usual due to a lack of programs and intermediate products.

Yu. Bekhtin, chief technologist correctly insisted on further accelerated renovation of outdated equipment. However, other speakers at the conference stressed that first elementary order should be brought in the use of what is already available. This was discussed by N. Zakharov, brigade leader of the steel workers, V. Zaytsev, foreman, Hero of Socialist Labor and N. Krylova, NC machine tool operator.

The work of V. Motorzhin, chief metallurgist, and A. Volodin, chief engineer, was also criticized. The work level of the engineering departments of the plant depend greatly on the exacting requirements of the plant's administration. Yet, they are obviously minimized. The following example was cited at the conference. The chief mechanical engineer's department was given such tasks as the repair of the production buildings, roofs, roads and the building of a number of structures although the association has a special construction service headed by A. Garbuzov, deputy general director. What happens? N. Poletakhin, mechanic, is involved in repairing a road, while expensive equipment in shops stands idle, and the introduction of measures to mechanize labor is delayed.

Many personnel questions at the plant matured and require solutions. In the chief technologist's department, for example, only a fifth of the engineers have special training. An influx of fresh forces and a greater effect of the party on production matters are needed.

Communists expressed their wishes to a new party committee that it intensify its attention to questions of selecting and placing cadres in all subdivisions, exhibit care in raising the ideological-political and professional level of workers, instilling feelings of high responsibility for an entrusted job. For this purpose, it is very important, first of all, to actuate the work of all shop party organizations and party groups and strengthen the influence of the party in decisive sections of economic activity.

In the report and specifics of delegates, just demands were made on managers in the Ministry of the Machine Tool and Tool Industry and the "Soyuzkuzmash" VPO [All-Union Production Association]. It is expected that N. Yendovitskiy, deputy minister, who was present at the conference, would reply, in his speech, to specific questions and remarks by conference delegates. Regrettably, he limited himself to thoughts on the general problems of the ministry.

Many business proposals and criticisms were made at the conference. It is now important to study them attentively in labor collectives of the plant, association, the VPO and ministry, and outline ways to eliminate shortcomings as quickly as possible, put available production reserves into action, for a worthy reception of the 27th party congress.

2291
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NEW APPLICATIONS OF ELECTRO-SPARK EROSION TECHNOLOGY NOTED

Moscow TEKHNIKA I NAUKA in Russian No 9, Sept 85 pp 22-26

[Article by B. Borisov, special correspondent: "Machine Tools 'Sensing' Metal"]

[Text] "A substantial increase in the reequipment coefficient must be the highest priority in the 12th Five-Year Plan period." This was stated at the April (1985) Plenum of the CPSU Central Committee. "The decisive word here is machinebuilding. Its development should be given priority..."

It is quite clear that machinebuilding cannot be developed successfully without high productivity machine tools. This was stressed at the April Plenum: "The greatest attention should be given to the improvement of machine tool building..."

What should modern metalworking machine tools be like? This was discussed at one of the recent meetings of the VSNTO [All-Union Council of Scientific Technological Societies] to which representatives of industrial enterprises and the Experimental Scientific Research Institute of Metal-Cutting Machine Tools (ENIMS) were invited. Of course, not all types of metalworking were considered, the framework of one meeting is too narrow for this. Specialists spoke about a most efficient technology -- the electro-spark erosion method (EE). Perhaps not one metalworking technology has developed as rapidly as the EE method. In the last five years alone, important changes occurred, not to mention the improvements during those four decades that passed after the invention of the EE method. One of these changes was that the method, whose shortcoming at its conception was low productivity in machining superhard metals, became more productive than traditional machining methods.

Our correspondent visited the ENIMS, becoming acquainted with the work being done by the primary scientific technological department of the institute which participates actively in the development and introduction of targets of a comprehensive program on electro-physical machining methods. This is the subject of his report.

Self-Restoring Electrode

At the start of the forties, Soviet engineers B·and N. Lazarenko turned their attention to the minute "pock marks," left by the electrical spark on the

surface. What if the metal is exposed not to a single electrical spark, but to gun shots of electrical discharges? Would they not make holes in the metal like drops of water make in a stone? We do not say that this is precisely the way the creators of a new metalworking method discussed the matter, but further research was directed precisely to this. As a result, an electro-spark erosion method was created for the first time in the world.

Why would an electrical spark make a hole in metal? Is not the nature of a spark the same as a welding arc, burning between the electrode and the metal being welded? Yet, in one case, the arc melts welded metal, while in the other case, it makes a hole.

The situation is that in welding, the arc power is concentrated and is measured in thousands of watts per square centimeter, while in a spark discharge, it is measured in millions of watts. With such a concentration of power, the energy of the electrical current, converted mainly into heat in the treatment zone, transforms the metal into a liquid or vapor state practically instantaneously. Between the discharges, although they follow each other only several hundredths or even thousandths of a second, the drop of molten metal ejected from the metal surface of the electrical pulse, falling into a cooled liquid (this is a must condition for electro-spark erosion), has time to congeal and is transformed into one of a billion drops that make up the powder-like chips.

Thus, to remove the "chips" from the intermediate product by the EE method, it is necessary to transform the intermediate product and the treating tool into a liquid medium and produce conditions at which the removal of metal from the surface of the intermediate product occurs hundreds of times more rapidly and intensively than from the working surface of the electrode. This is the whole thing!

How can this be achieved? But according to laws of physics, heat at the cathode and anode is emitted in about the same amounts.

A reader, superficially acquainted with EE treatment, will say that everything is very simple; the intermediate product is steel, while the electrode tool is carbon or copper; therefore, erosion proceeds at various speeds. Correct. However, the difference due to the thermo-physical properties of the materials of the intermediate product and the electrode, is theoretically not so great. The difference may provide removal of excess metal from the intermediate product tens, but not hundreds of times, as is necessary. Yet, the effectiveness of the electro-spark erosion is present! Why? The basis of the physical model for the durability of the electrode tool, for example, made of copper is a hypothesis on itself-restoration, the essence of which is that in the process of treatment, the electrode is coated by a carbon film.

Since the melting temperature of copper is 1083^{o}, while that of carbon is 4000^{o}, two versions of the process are possible: the electrical discharge energy is only enough to destroy the film along its entire depth, while the copper of the electrode is almost not destroyed; there is enough energy to

destroy the film and the copper, but there is less destruction in copper and it accepts a considerable part of the thermal shock. A third version is not excluded: there is not enough energy to destroy the film, but enough to melt the electrode surface under the film. In this case, the molten copper, increased in volume, "explodes" the film from the inside and splashes out into the working (cooling) liquid. It would seem that in this case there must be maximum wear of the electrode, but actually there is not. The energy of the electrical discharge is sufficient not only for destruction but also for creation. The working liquid in the layer, near the electrode surface, heats up to the temperature of pyrolysis (thermal decomposition) while, since the working liquids (oil, kerosene, emulsion) are of organic origin, graphite is separated from them and forms a new film on the electrode surface.

The process of destruction and reproduction, which we have described, proceeds continuously. Thousands of electrical discharges participate in it simultaneously; thousands of chaotically originating microelectric arcs, "combining" into a single pulse in a hundredth or even a thousandth of a second. A system with a multiplicity of parameters changing in time and space is produced. How can all of this be reduced to one denominator?

Scientists and engineers, having identified such process characteristics as the shape of the electrical pulse, porosity (ratio between the succession period of the pulses and their length), current strength, composition and speed of replacement of working liquid, pulse energy, hydromechanical force etc., built physical models -- of productivity, erosion durability of the electrode-tool and the control process. When they learned to control the precision of the productivity, of treatment and the durability of the tool, such technological wonders became possible.

Hard Alloy is Cut Like Plywood!

We are now in the demonstration hall of the All-Union Consultation Center organized at the ENIMS by the decision of the Ministry of the Machine Tool and Tool Industry and the USSR VDNKh.

Two dozen machine tools operate in a small hall, representing all types of electro-physical and electromechanical machining of metals.

"Please note the silence," stated A. Sosenko, candidate of technical sciences and leading staff worker of electro-spark erosion machine tool laboratory. If all work, done at present in this hall, was performed by milling, boring and drilling machine tools, imagine the noise they would make in our small shop! It would hardly be possible to locate them here because a single universal metal-cutting machine tool, as a rule, could not produce a finished irregular part. This means that it would be necessary to put a grinder beside the lathe,, while a workbench would have to be placed besides the boring or milling machine tool near which a highly skilled mechanic would produce the final finished product."

Moving from one machine tool to another, A. Sosenko described their possibilities. Here is an NC model 4732F3 electro-spark erosion machine tool.

In it the metal is cut by a very thin wire. It cuts metal like a jig-saw cuts plywood. The wire cuts almost "soft" steel and brass almost as easily comparatively as a hard alloy. Now a plate of hard alloy about 20mm thick is mounted on the table of the machine tool. It is difficult to believe that the machine tool is finishing cutting a part in the shape of a fantastic flower using a copper wire 0.25mm in diameter as a cutting tool. It would seem that the very first spark would melt it as would a fuse by a short-circuit. Or, becoming thinner (the wire does not even have a graphite protective layer), it would evaporate after a few seconds of operation. But what I see, however, is that it cuts and cuts and I hear only the weak crackling of the electrical discharges. The width of the cut by the electrode over the entire path is practically the same no matter how long and winding the path. Only several hours are needed for the manufacture of a blanking die set. The plate from which the fantastically shaped die is cut becomes the female die, while the cutout part becomes the upper die. The machining and consequent benchwork would require several days to make such a set.

High productivity and precision of electro-spark erosion for cutting steel became possible by the realization of a magnificiant technical idea: an endless electrode wire is continuously uncoiled from a spool and passes through the cutting zone with such speed that there is not time for it to melt; or to "deteriorate."

Amazing products can be seen on the demonstration stand near the electro-spark erosion model 4D722AF profile-broach machine tool. A headlight diffuser -- a convex lens with a distinct and very complicated picture of interwoven projections, channels, sloped surfaces, is shown. Right beside it lies a highly polished mold -- a mirror image of the diffuser in which it was cast. It can be said that the mold was made by the copper electrode, with one contact. To make it by the usual technology, using several machine tools and a very highly skilled mechanic, would require a full shift and maybe more.

There is also a female die of a forging press for making automobile crankshafts and beside it a die for a fashionable rubber boot for which it was made. This die is made several times faster than by the usual method.

The basis of the electro-spark erosion form-shaping process is the same principle: electrical discharges "dig-out" powder-like metal particles from the surface of the intermediate product. Imagine soft clay and the glass of an automobile headlight pressed into it. Its mirror image female die remains in the clay. This is also the way a mold is produced in metal, except that the metal is not pushed to the side and is not condensed, as in clay, but is carried from the treatment zone by a flow of continuously pumped working liquid.

Would it not have been simpler for the mechanic to obtain the female mold at once,? a reader can ask. In fact, first, it is necessary to make a precise copy of the future product from copper. Copper is not clay, therefore, the electrode cannot be molded: it must be ground, polished, then used to make the female mold itself.

But everything is done much more simply and faster. The pattern-maker makes a wooden copy, for example, of the boot (or any other article). A gypsum model is cast from it and a layer of copper is sprayed on it. The electrode-tool is ready.

What Else?

All the possibilities of electro-spark erosion cannot be enumerated in a journal article. Here are only a few of them.

Female dies with complicated shaped holes for extruding metals are produced as simply as bushings on lathes. In this, the technologist can incorporate any fantasy of the designer, while the labor-intensiveness is reduced to 1/3.

Various templets can be made from previously hardened steel, leaving allowances for finishing of not over 0.05mm which almost halves the volume of the following machining.

The working blades of gas turbines, pump and turbine vanes (products with the most complicated machining) are produced on copying-broach electro-spark erosion machine tools as simply as the usual spockets on milling machine tools. The machining time of a working blade of a gas turbine 300mm in diameter is 1/10 of the time necessary for milling machine tool. The manufacturing time of turbine vanes is reduced to 1/3, several metal-working machine tools are freed and the costs of machining tools are reduced to less than a tenth.

Holes of any desired shape, at any angle to the surface can be made in the walls of bushing and housing parts of any thickness (from tenths to tens of millimeters). The roughness of the treated surfaces, in this case, will not be over 1.5 micrometers which is very important in various hydraulic apparatus.

During the electro-spark erosion treatment, the intermediate product feels practically no pressure by the tool. Therefore, it is possible to make grooves or channels, manufacture thin screens and membranes with a precision of up to several hundredths of a millimeter, in very thin plates without deforming them. It is possible to manufacture screens for electrical vacuum devices with holes of any shape and with a connection width only two-three hundredths of a millimeter.

Machining parts of complicated configuration or from difficult to machine materials can be done by EE three, five, ten and, sometimes, twenty-fold faster. Its main advantage, however, is the possibility of doing the impossible. Imagine that it is necessary to make crescent-shaped depressions, say, of circular cross sections, along the generatrix of the working blade of a gas turbine with superhigh parameters. Perhaps, there is a drill that can curve into an arc when it penetrates metal? No; there is no such drill. And it is hardly possible. What if it is also necessary to make the crescent-shaped depression, not with a round cross section, but of a rectangular cross section and in a superhard, refractory alloy? This could not be done without EE for which this technological miracle is a common task. The electrode tool is made in the shape of the necessary groove and after that -- it is no more complicated than machining the blade on a milling machine tool.

EE and the Scientific Technological Soceity (NTO)

The importance of EE treatment for the development of modern machinebuilding, power, instrument building and radio-electronics is difficult to overestimate. At present, there have been developed and are series manufactured several dozens of NC profile-broaching and cutout EE machine tools -- the native country of EE-treatment -- possibly, the largest in the world. The output of equipment increases year after year. Many plants which became acquainted with the new technology cannot think of being without its further development.

"So that there are no problems?" I asked A. Belov, deputy chairman of the NTO Council.

"There are always problems -- things do not stand still.... Here is our institute, a laboratory was created for the development of electrophysical treatment methods. Its goal is to achieve higher precision and a higher degree of finish of the surfaces of machined parts by almost an order of magnitude, so that the surface roughness would not exceed tenths of micrometers. This requires generators of current with a frequency of several hundred kHz, but with a low energy pulse and a duration of only several microseconds. Such generators have been developed, but their output is low. On the other hand, equipping electro-spark erosion machine tools with such generators poses new scientific and engineering problems. For example, it is necessary to maintain a very precise gap between the electrode-tool and the intermediate product. The usual automatic control is not sufficient here. Adaptive control is required, i.e., the machine tool must adapt itself instantaneously to the continuously changing conditions of the electro-spark erosion process, as though feeling the machined intermediate product."

"The second problem is that it is time to change over from automating individual machine tools to automating sections and even shops. In this case, the sections should include not only EE equipment, but also a set of metal-cutting machine tools necessary for manufacturing intermediate products and other auxiliary equipment. All these must be controlled by one computer. The success of such a large and complicated matter will greatly depend on the activity of local scientists and engineers."

"In this connection, still another problem arises -- that of an informational nature. A consultation-information center which you just visited has already been in operation for over 10 years at the ENIMS. Here, plant technologists are able not only to become acquainted with the existing and future equipment, but also to check its effectiveness in solving their own, specific production problems. Constant courses are given here which about 2000 plant specialists have already taken. Representatives of several thousands of enterprises have already become acquainted with modern equipment and technological processes. However, there are still enterprises, some fairly large, which have only very approximate concepts of the new possibilities of the electrophysical machining of metals. I think that the active participation of primary NTO organizations is especially necessary here. Who, if not engineers -- NTO members, must take over advanced experience?"

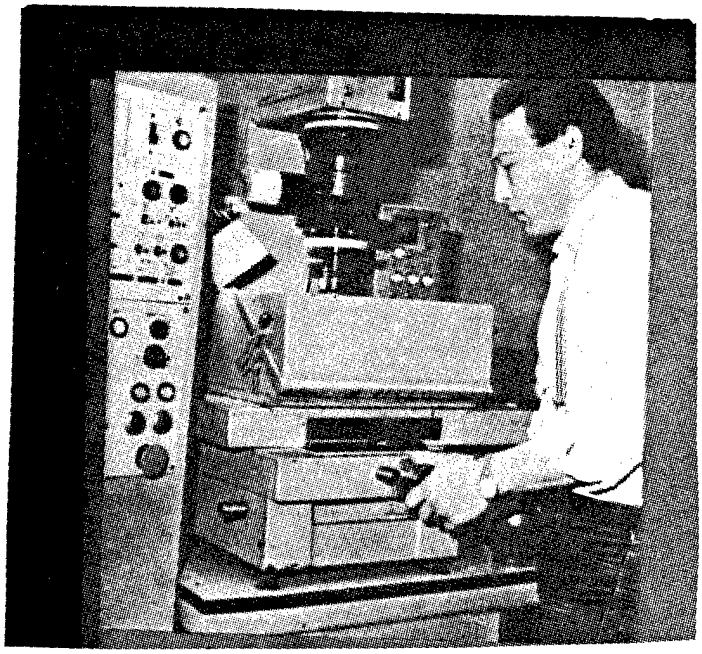


Fig. 1. Model 4B611 machine tool designed for removing a broken tool or fixture from expensive products. The electrode-tool in the shape of a copper tube forms a ring cavity around a stuck fragment of a drill or tap, without touching the wall of the hole. The fragment is then removed easily.

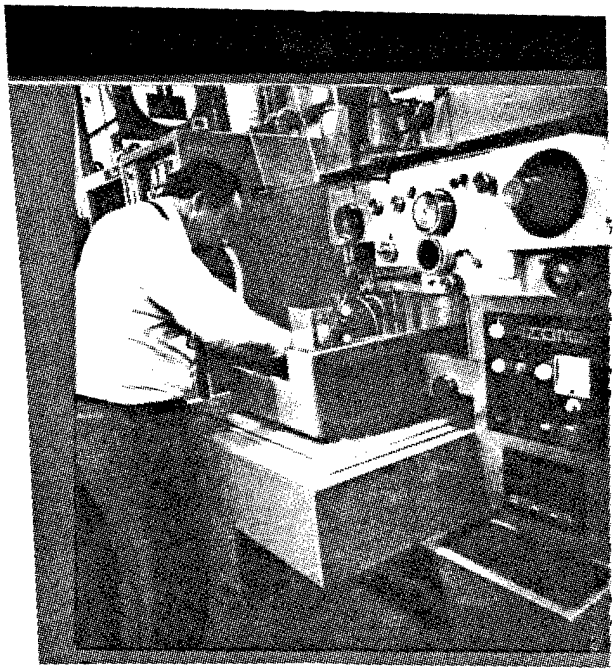


Fig. 2. Adjustment of NC model 4733PF3 electro-spark erosion machine tool.

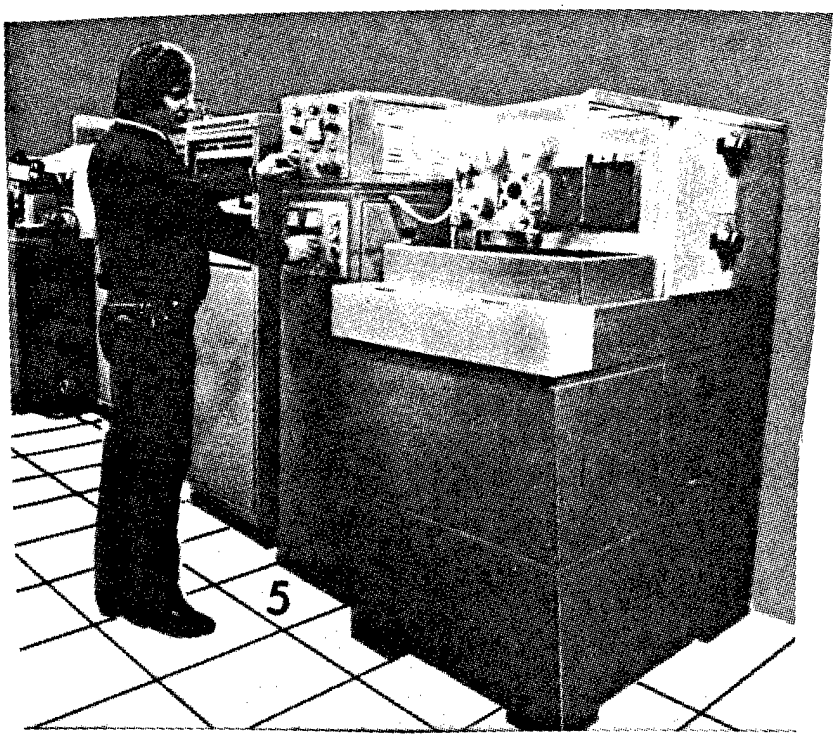


Fig. 5. NC model 4732F3 electro-spark erosion cutout machine tool.

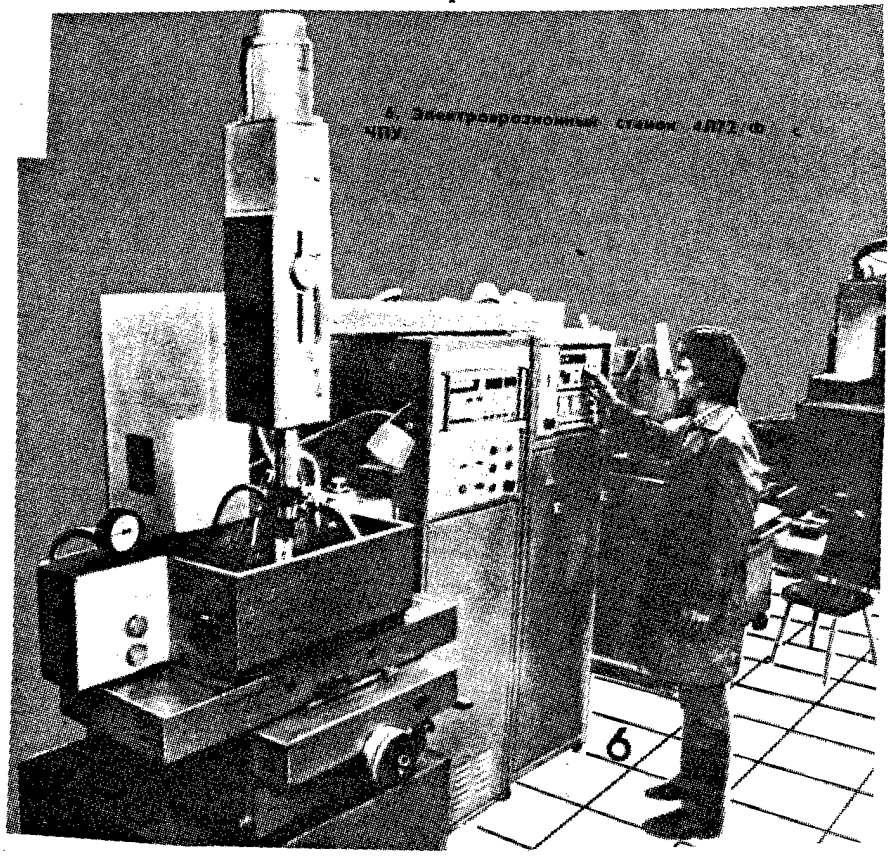


Fig. 6. NC model 4172 (F) machine tool.

"Specialists consider that the share of EE treatment in manufacturing dies, molds, etc. of structural (comparatively easily machined) steels must be not less than 40 percent, while of hard alloys -- not less than 80 percent; in machining turbine vanes -- not less than 50 percent; in manufacturing stainless and refractory steels and alloys -- not less than 10 to 15 percent."

"It should be noted that each ruble invested in EE equipment will produce no less than three rubles of profit for the enterprise.

2291
CSO: 1823/040

UDC 621.979-82.001

EXPERIENCE WITH DOMESTIC, FOREIGN PRESSES REVIEWED

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 4, Apr 84 pp 3-5

[Article by A.N. Kurovich: "New Hydraulic Press Equipment For Elastic Medium Sheet Metal Stamping and Its Development Prospects"]

[Abstract] The Soviet Union recently began to stamp parts from certain high-strength materials and therefore needed powerful hydraulic presses for elastic-medium stamping. It manufactured some of its own presses and bought others abroad. Sweden provided the Soviet Union with plunger-type 100-MN presses and direct-action 600-MN presses. The Soviet Union adapted the plunger press design to make 100- and 200-MN presses with a specific press force of 60 MPa. Four years of experience operating West German presses showed them to be inconvenient to operate because of their mechanical design and inability to satisfy full technological specifications. Even with a series of modifications, the German presses still did not produce full pressing force. A chief shortcoming of direct-action presses was the low durability of the elastic diaphragm. Their performance showed that the sealing of the oil chamber was unreliable and diaphragm distortion during operation caused many equipment failures. It was very difficult and costly to dismantle or replace the elastic unit. Due to the low durability and high cost of the QRD600 press's elastic unit, factories using them had to lower their working pressure twice. The Soviet design for the elastic diaphragm used in the 110-MN P5650 press had none of these defects. It was a self-sealing single-element concave polyurethane membrane that stretched less under operation. The P5054 plunger press with a multi-layer polyurethane elastic bed worked over a long period of time at a pressure of 240 MN and a specific force of 100 MPa. It was easier to maintain and could stamp several hundred types of parts from high-materials. Improved designs based on different Soviet and foreign presses were recently produced for high-output sheet-stamping machines. Metal content in the press bases was lowered through the use of windings from high-strength metal tape and the plunger cylinder was placed in a lower position. The machines were found to be durable up to 100 MPa of working pressure. Various adaptations of existing designs made it possible to create presses for various uses and of good operating characteristics. Metal content was reduced. Sheet materials that could not be deformed at pressures under 100 MPa began to be used and it became necessary to increase working pressure and introduce the stamping of heated blanks but specialized presses were still lacking. References: 2 Russian.

12261/12232
CSO: 1823/42

BRIEFS

PUNITIVE SANCTIONS -- The Gosstandart checked the observance of standards and specifications in the manufacture of antifriction bearings in a number of government bearing plants. No infringements were found in most checked plants. Two type-sizes of bearings at the Vologodsk GPZ-23 plant failed to meet specifications for a number of indicators. The sale of these two type-sizes of bearings was withdrawn. The cost of the poor quality bearings of over 2.5 million rubles was removed from the report on plan fulfillments, and 105,000 rubles of profits were removed from the budget. Both type-sizes of bearings were deprived of the State Emblem of Quality. Serious infringements of specifications were also found at the GPZ-10 Plant (Rostov-on-the Don). Two type-sizes of bearings manufactured by the plant were not according to specifications. The plant was forbidden to sell the products. About 7 million rubles were excluded from the fulfillment of the plan, and 1.67 million rubles of profit received illegally from the sale of scrap products were removed from the budget. The products were deprived of the State Emblem of Quality. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 29, July 85 p 9] 2291

PUNITIVE SANCTIONS FOR VIOLATIONS -- The Ministry of Machine Tool and Tool Industry presented to the USSR Goskomtsen in July 1985 a wholesale price plan for model KA3540 two-crank, closed-die simple action press. In considering this plan, it was established that previously, in 1982 and 1984, the Voronezh "Tyazhmekhpress" Production Association (A. Kruk, general director), in violation of the existing order, sold such presses illegaly charging excessive prices for an experimental lot. The USSR Goskomtsen approved the wholesale price of the indicated press in the established order and adopted a resolution to remove, from the budget of the "Tyazhmekhpress," 391,250 rubles received as a result of the excessive price for this press, as well as to remove 218,600 rubles from the report data on fulfilling the plan for the volume of the norm of net output for the indicated periods. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 32, Aug 85 p 8] 2291

CLOSED-DIE FORGING COMPLEX -- The closed-die forging complex, introduced at the Riga Electrical Machinebuilding Plant, consists of a PRP-5 automatic manipulator, a two-position rotary table with a device for a piece-by-piece oriented feed of intermediate products, a receiving device for finished parts, a model REZ-25 kilo-newton crank press, a pneumatic station and a

cyclic control system. The manipulator is equipped with two horizontal arms with an independent drive for advancing. The arms move along the vertical and rotate with respect to it. The introduction of one complex increases the productivity of labor by 50 percent and increases the utilization coefficient of the basic technological equipment; it frees one worker from heavy, monotonous work; it facilitates an increase in the standard of production [USSR VDNKh] [Text] [Moscow MASHINOSTROITEL in Russian No 2, Feb 85 p 21] [COPYRIGHT: Izdatelstvo "Mashinostroyeniye", "Mashinostroitel", 1985] 2291

CSO: 1823/040

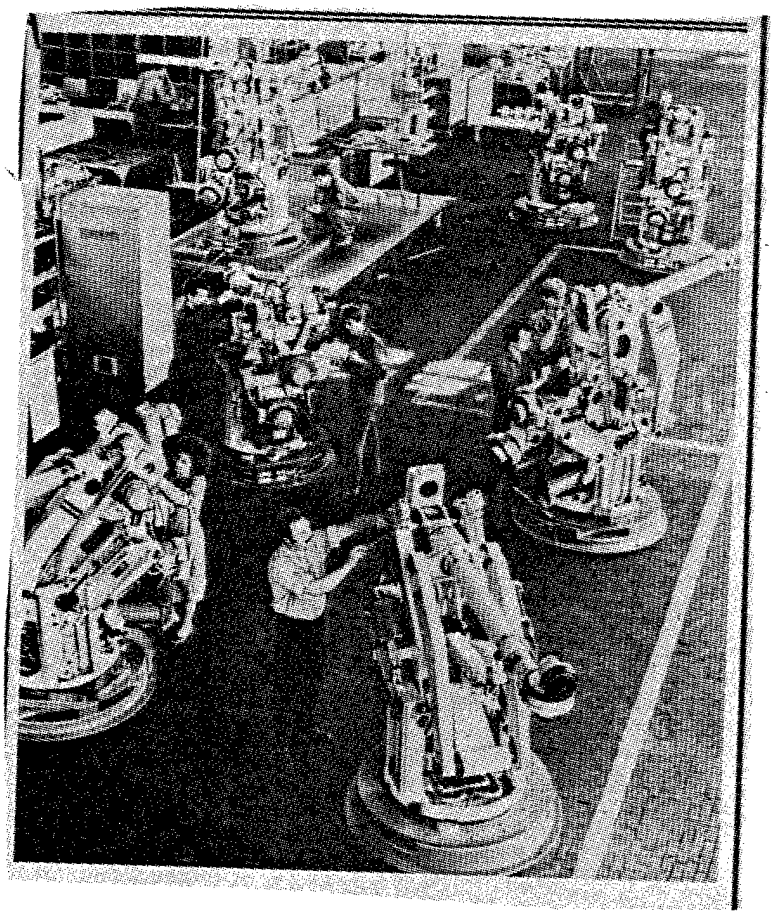
SERIES PRODUCTION OF 'BETTA' ROBOTS IN TOGLIATTI

Riga SOVETSKAYA LATVIYA in Russian 5 Sept 85 p 2

[Article TASS (Togliatti, Kuybyshevskaya Oblast)]

[Text] The collective of the "AvtoVAZ" Association, having come forward with the initiative to accelerate scientific technological progress and increase efficiency of production in the 12th Five-Year Plan period, obligated themselves to renovate and modernize the entire output. It was decided to reduce the time for preparation and starting series production of new models from eight to five years. For this purpose, new production buildings were built and modern automatic flow lines, complexes and high productivity equipment were placed in operation.

A large shop is in operation at the Association building automatic helpers - robots. Series production of new "Betta" multipurpose robots began recently. They can operate successfully in sections for welding, machining parts, painting, washing and they ease the labor of workers in transport operations, carrying loads up to 100kg. Today, the new robots are entrusted with work in welding complexes.



Shop for assembling "Betta" robots.

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TREND TOWARD THIRD GENERATION INDUSTRIAL ROBOTS NOTED

Riga SOVETSKAYA LATVIYA in Russian 5 Oct 85 p 2

[Article by M. Melkonyan (APN): "To 'Manless' Technology"]

[Text] Specialists claim that by the start of the 21st century an overwhelming majority of people will be occupied in science, education and culture, control, commerce and other infrastructure activities. Only about 20 percent will remain in direct production at plants, factories, mines, electrical power plants and agriculture. Machines and automatic devices will become the basic producers of material goods.

"Are not the authors of such forecasts in too much of a hurry?

"No," replies Vasiliy Belov, general director of the Experimental Scientific Research Institute of Metal-Cutting Machine Tools (ENIMS), "the development trends are absolutely correct."

"While in 1975 the number of robots in the world was 8000, in 1980 -- about 30,000, then by 1990 it will approach 300,000. Their basic mass will be the third generation with so-called artificial intelligence."

"Robots and microprocessors," stated Igor Makarov, chairman of a scientific council on the problem "Robots and robot equipment systems" in the USSR and member-correspondent, "create the basis for full changeover to automatic production. They are called flexible, because they can be readjusted rapidly from production of one kind of output to another. Or, 'manless,' because a minimum number of workers will be required to service them."

For several years, the Dnepropetrovsk Electrical Locomotive Building Plant has had an automated shop in successful operation. The shop has NC machine tools, robots-manipulators and devices for removing chips. Warehouses and intrashop transport are also automated. All subdivisions are controlled electronically.

The Dnepropetrovsk shop is one of about 60 flexible automatic productions created in our country. There will be about 2000 by 1990. We are speaking of a principally new organization of labor, as well as about qualitatively new equipment.

Thus, in the three years of the current five-year plan alone, over 19,500 automatic manipulators or triple that in 1980 were manufactured in the USSR. During this same time, the production of microprocessors increased almost 5-fold and of microcomputers -- more than doubled. Some 1200 automatic technological process control systems were introduced, or almost as many as during the entire previous five-year plan period.

The course on creating "unmanned" enterprises was also taken by the CEMA countries. Recently, I visited an enterprise of the "Gostivarzh" Machine Tool Building" concern (CSSR). Its specialty is integrated production sections for machining rotary and housing parts. They are controlled by minicomputers developed in the CEMA countries. In each of these sections, the productivity of labor is 1.8 to 2.3-fold of that where the usual machine tools are installed.

At an exhibition dedicated to the 40th Anniversary of socialist development in Bulgaria, held in Moscow, there was an exhibit of a flexible automatic system, whose prototype operates at the Staro-Zagora "Beroye" Scientific Production Combine. Robots in this system were made in Bulgaria, while the NC machine tools were made at the Moscow "Krasnyy proletariy" Plant.

The cooperation of machinebuilders is aimed at the best world prototypes. On this basis, there will be created high productivity equipment, flexible readjustable automated systems and in the future, also "manless" enterprises will be developed and introduced.

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BRIEFS

SEEING ROBOTS -- A narrow strip of an aluminum alloy is laid between an automated warehouse and plant shops. A modular design MP-14T transportation robot travels over this strip. This robot was developed by Leningrad designers and engineers. The manipulator is equipped with a control system with optical electronic sensors. They "catch" the light reflected by the strip, which issues the instruction to the robot about changing its movement. A model MP-8 industrial robot with technical sight arouses interest. At the ends of its "fingers", little bulbs are lit, while a TV camera follows the movement of the arm. Coded signals enter the "Elektronika-60" miniature computer which controls the robot. The new robot is designed for sorting and assembling operations in the most varied sectors of industry. These robots are exhibited at the "Machinebuilding"Pavilion of the "Industrial robots and robotized technological complexes" exhibition. [Text] [Riga SOVETAKAYA LATVIYA in Russian 18 Oct 85 p 2] 2291

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